Dural Arteriovenous Fistulas: Unusual Access Routes in the Elderly

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Summary

Transvenous embolization is effective in the treatment of an intracranial dural arteriovenous fistula (DAVF). Retrograde venous access to the fistula may be limited by associated sinus thrombosis, as in the two cases here reported. Unusual curative access routes were performed: direct superior ophthalmic vein puncture and through a small craniectomy, packing the sinus with detachable coils. When traditional routes proved impossible, unusual access routes must be devised.

Introduction

Dural arteriovenous fistulas (DAVFs) account for 10%-15% of all intracranial arteriovenous malformations, consisting of abnormal vascular connections located within dura mater, draining into dural sinuses or adjacent meningeal veins [1].

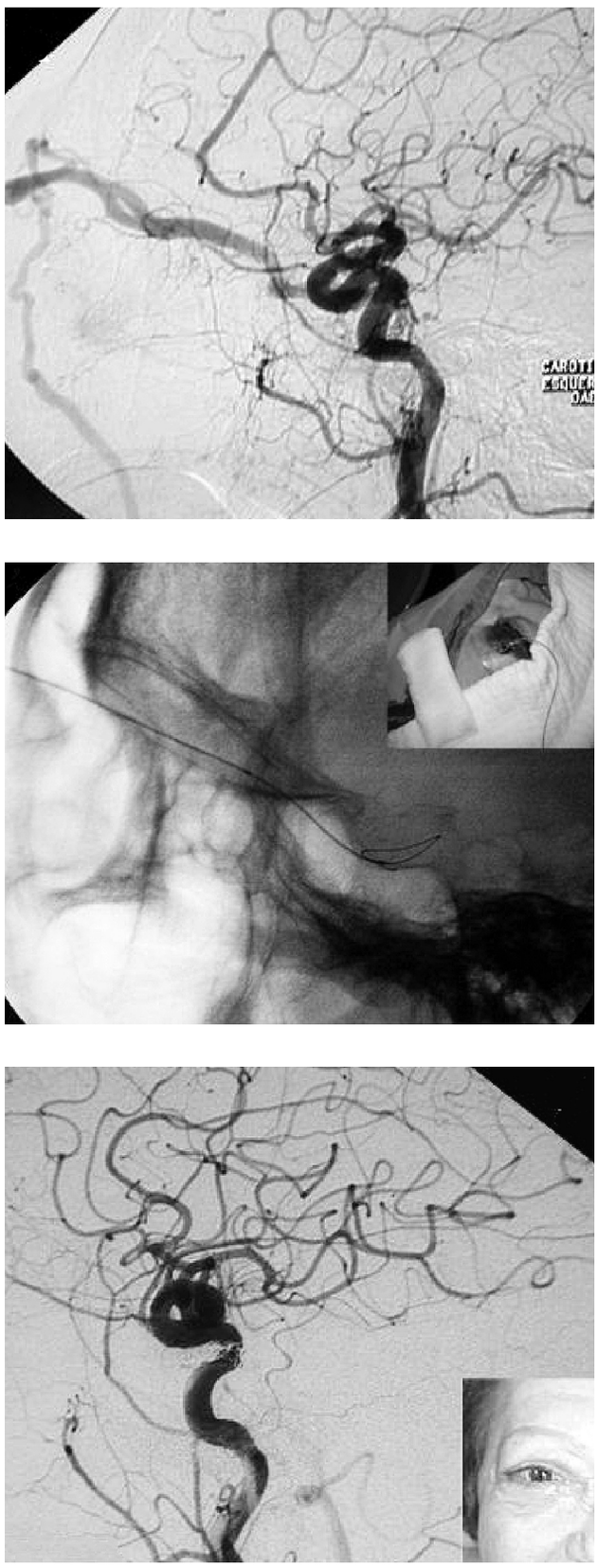
We present two cases of DAVFs transvenous embolization, where the retrograde or contralateral catheterization of the parent sinuses was not possible by the usual venous access routes through common femoral or internal jugular vein punctures.

Case 1

An 82-year-old woman presented with a four-month history of right eye redness, proptosis, and diplopia associated with secondary glaucoma and decreased visual acuity. A digital subtracted angiogram (DSA) revealed a DAVF of the right cavernous sinus fed by multiple branches from both external carotid arteries draining exclusively toward the right superior ophthalmic vein.

In the neuroangiography room (GE-Advantix Biplane, ver houdart), under general anesthesia and full heparinization, several attempts to reach the cavernous sinus through the thrombosed inferior petrous sinus were unsuccessful. An approach through the right superior ophthalmic vein was decided. Under high-quality biplane road-mapping guidance, a direct puncture of the superior ophthalmic vein was performed using a 22 G Jelco. A 0.010-in microguidewire was introduced (Transend 10, Target-Boston Scientific, La Garenne-Colombes, France) and the 22 G Jelco was exchanged for a 20 G that was used as a sheath for the introduction of a Prowler 14 microcatheter (Cordis, Miami Lakes, FL). The cavernous sinus was reached and packed with six GDC standard coils (Target-Boston Scientific). The final DSA showed complete exclusion of the fistula. After heparin reversal the Jelco was withdrawn with soft digital compression for fifteen minutes.

A light haematoma was formed in the periorbital tissues which regressed completely after one month with only local care (figure 1C). The patient recovered completely and a DSA three months later confirmed the stable result.



Case 2

A 79-year-old woman presented with a history of worsening headache, dizziness, visual disturbance and difficulty with balance. DSA disclosed DAVF involving the left transverse-sigmoid sinus transition, supplied by multiple feeders from the left external carotid branches (occipital, superficial temporal, middle meningeal and posterior auricular arteries, figure 2A). The transverse-sigmoid junction was cloistered by distal transverse and proximal sigmoid sinus occlusion, leading to a prominent retrograde drainage into infratentorial engorged veins (figure 2,B). The patient and relatives refused invasive treatment.

Two weeks later, the patient's clinical status deteriorated with the acute onset of coma. She was hospitalized in our institution's intensive care unit and treatment arranged. In the neurointerventional room, a transvenous approach was attempted, but from both sides it was impossible to reach the fistula site. Due to the lack of retrograde transvenous access, a combined procedure was scheduled for the next day.

In the neurosurgical room, with DSA pinpointing, a small craniectomy was performed and the skin sutured over the hole. The patient was directly sent to the neurointerventional room for transcranial direct puncture of the transverse-sigmoid junction under high-quality road-mapping guidance (figure 2C). A 18 G Jelco was used as a sheath for a 2.6 F microcatheter insertion (Excelsior 18, Boston Scientific), packing the sinus with seven detachable coils (DCS, Cook, Charenton, France) (figure 2D). The final angiography showed complete obliteration of the lesion (figure 2E,F). The patient woke up at the next day and was completely asymptomatic after one week. She decined a three month control DSA.

Figure 1 A) Lateral left common carotid artery DSA shows a cavernous sinus fistula draining exclusively toward the right superior ophthalmic vein. B) Percutaneous direct puncture of the right superior ophthalmic vein, accessing the cavernous sinus. C) Post-embolization right common carotid DSA shows complete occlusion of the lesion.

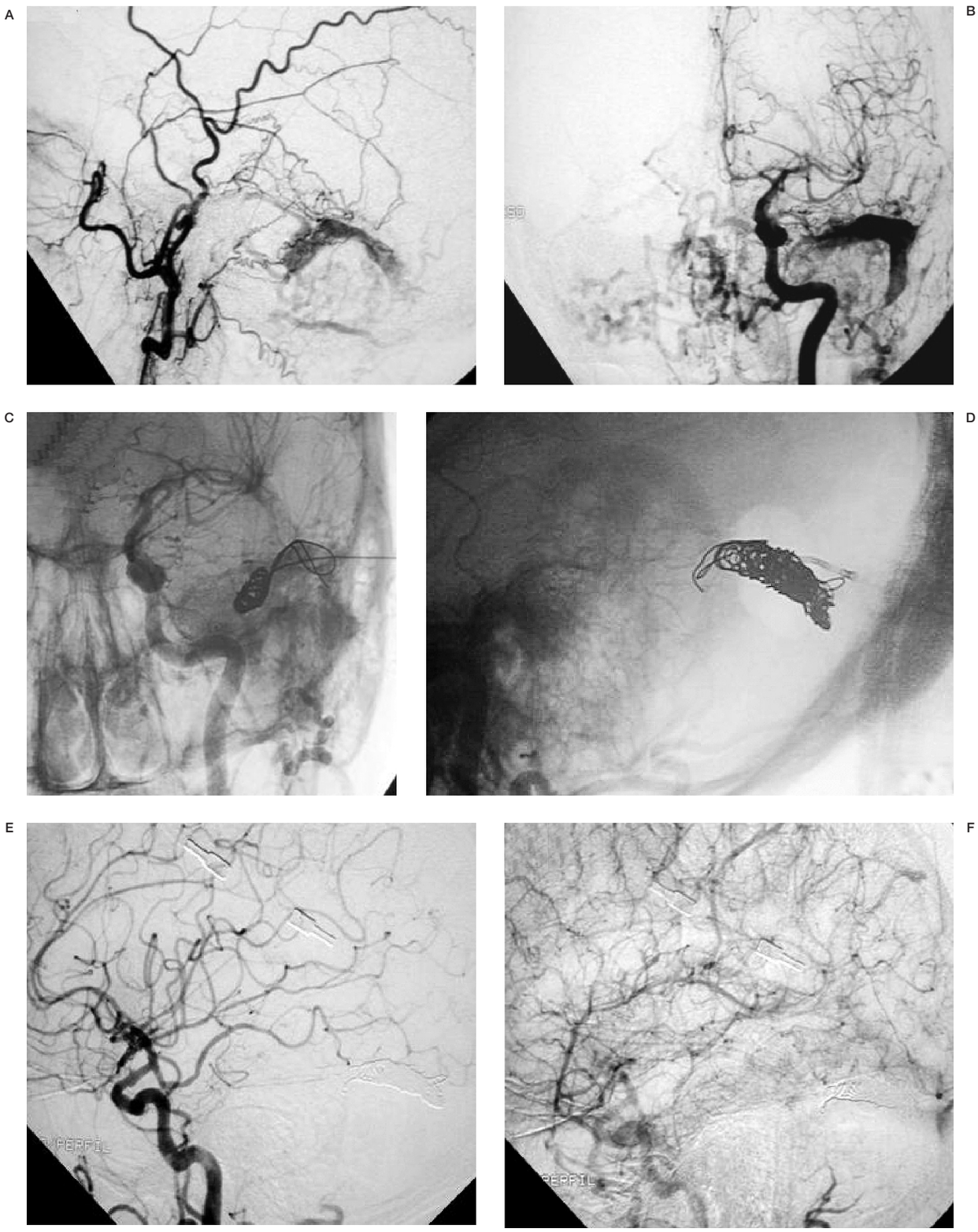


Figure 2 Selective external (A) and internal (B) left carotid artery showing the DAVF with a cloistered transverse-sigmoid junction. After a small craniectomy a direct percutaneous puncture (C) permitted sinus packing (D). Final left common carotid DSA, arterial (E) and parenchymal (F) phases, with lesion exclusion.

Discussion

DAVFs of the cavernous sinus usually have an indolent course, low morbidity and a considerable resolution rate, spontaneously, after carotid manual compression or even after angiography [2].

Therapy is indicated in the presence of progressive symptoms, decreasing vision, glaucoma, persistent ophthalmoplegia, or an unacceptable physical appearance. It's also mandatory when cortical venous reflux (CVR) is observed, usually around 30% [2,3].

The risk of cranial DAVFs are dictated by their pattern of venous drainage, with features such as CVR and venous congestion believed to contribute to an aggressive presentation with haemorrhage, non haemorrhagic neurological deficit or death [4,5,6]. The main feature of management is that patients with CVR must be cured and those without may be followed up clinically or partially treated for symptoms palliation [4,6]. Complete cure by arterial embolization is very difficult because of the multiplicity of the feeding arteries in most cases. Embolization with particles is considered to be the treatment posing fewest risks, but long term results are disappointing, showing a high degree of arterial recanalization. Each pedicle embolization with glue is often time-consuming, has potential complications and a variable rate of success, being particularly troublesome in the older population with arterial tortuosity. Transvenous embolization is safe and effective, been advocated by several neurovascular groups as the best approach, mainly when the goal is an anatomic cure [2,4,7-9].

When possible, transvenous complete sinus occlusion is our approach, but sometimes it no longer communicates directly with the jugular vein because of associated sinus thrombosis. In such cases, recanalization of the sinus may be attempted, but it is not always successful. Cavernous sinus catheterization through the superior ophthalmic vein has been described by direct puncture or surgical exposure [2,3,7], the latter being the most recommended [7]. Currently available small hydrophilic microcatheters allow the use of a 20 G Jelco as a sheath, which minimizes trauma to the vessel and reduces the risk of haemorrhage caused by rupture of an arterial-flow intraorbital vein[2,7]. Nevertheless, this approach is only justified when the inferior petrous sinus route had proved impossible.

On the other hand, when the DAVF involves a sinus located close to the skin, a feasible and effective solution is to access the sinus by direct puncture through a planned craniectomy. Houdart et Al.[10] recently published their experience with curative transcranial approach for venous embolization of DAVFs in ten patients, with previous failed interventions in nine, coils being the most used embolic agent. We feel more confident embolizing the lesion in the neuroangiographic suite, with better quality angiographic equipment and a greater variety of endovascular tools. For this, it is necessary to create a craniectomy, covered by sutured skin, allowing a direct puncture.

Conclusions

Symptoms and prognosis of DAVFs are mainly related to the type of venous drainage. The careful evaluation of the lesion architecture helps to define the proper treatment strategy, with venous sinus packing, when possible, been the most effective curative endovascular option.

When traditional routes proved impossible, unusual accesses have to be considered, emphasizing once more the close cooperation of neurosurgeons and interventionists, improving outcomes from such complex disorders.

References

1 Roy D, Raymond J: The Role of Transvenous Embolization in the Treatment of Intracranial Dural Arteriovenous Fistulas. Neurosurgery 40: 1133-1144, 1997.
2 Monsein LH, Debrun GM et Al: Treatment of Dural Carotid-Cavernous Fistulas via the Superior Ophthalmic Vein. Am J Neuroradiol 12: 435-439, 1991.
3 Cheng KM, Chan CM, Cheung YL: Transvenous embolisation of dural carotid cavernous fistulas by multiple venous routes: a series of 27 cases. Acta Neurochir 145: 17-29, 2003.
4 Davies MA, Saleh J et Al: The natural history and management of intracranial dural arteriovenous fistulas, 1: benign lesions. Interventional Neuroradiology 3: 295-302, 1997.
5 vanDijk JMC, terBrugge K et Al: Clinical Course of Cranial Dural Arteriovenous Fistulas With Long-Term Persistent Cortical Venous Reflux. Stroke 33: 1233-1236, 2002.
6 Willinsky R, Goyal M et Al: Tortuous, Engorged Pial Veins in Intracranial Dural Arteriovenous Fistulas: Correlations with Presentation, Location, and MR Findings in 122 Patients. Am J Neuroradiol 20: 1031-1036, 1999.
7 Benndorf G, Bender A et Al: Treatment of a cavernous sinus dural arteriovenous fistula by deep orbital puncture of the superior ophthalmic vein. Neuroradiology 43: 499-502, 2001.
8 Cognard C, Casasco A et Al: Dural arteriovenous fistulas as a cause of intracranial hypertension due to impairment of cranial venous outflow. J Neurol Neurosurg Psychiatry 65: 308-316, 1998.
9 Dawson RC, Joseph GJ et Al: Transvenous Embolization as the Primary Therapy for Arteriovenous Fistulas of the Lateral and Sigmoid Sinuses. Am J Neuroradiol 19: 571-576, 1998.
10 Houdart E, Saint-Maurice JP et Al: Transcranial approach for venous embolization of dural arteriovenous fistulas. J Neurosurg 97: 280-286, 2002.

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EDITORIAL COMMENT

The direct puncture of the SOV is not an unusual access. The first publication on SOV access to the cavernous sinus was done by our service in 1986[1] *(actually 3 years before the publication). At that time we had problems in one case due to the fragility of the veins and risk of haemorrhage, suggesting we had to wait for venous arterialization before performing this approach. By dissecting the SOV there is more control of bleeding than by direct puncture. After that publication, many other authors have published on this approach.*

The most elegant and least dangerous is the catheterization of the SOV by femoral-jugular-facial vein route with a guiding catheter or jugular or even facial veins direct puncture, as we avoid the risk of intraorbital bleeding.

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1 Uflacker R, Lima SS, Ribas GC, Piske RL. Carotid-cavernous fistulas: embolization through the superior ophthalmic vein approach. Radiology 1986:159:175-179.